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(54) LIQUID CRYSTAL VIDEO PROJECTOR SYSTEM

SPECIFICATION

1. Title of the Invention:

LIQUID CRYSTAL VIDEO PROJECTION SYSTEM

2. Claims

(1) A liquid crystal video projection system of a liquid crystal video projector comprising at least a light source lamp, an illuminating optical system, a liquid crystal panel, and a projection optical system, characterized in that both an intake fan and an outlet fan are provided for cooling deflecting plates.

(2) A liquid crystal video projection system as claimed in claim 1, characterized in that both an intake fan and an outlet fan are provided for cooling a light source.

(3) A liquid crystal video projection system as claimed in claim 1, characterized in that both an intake fan and an outlet fan are provided for cooling a color filter.

3. Detailed Description of the Invention

[Technical Field of the Invention]

The present invention relates to a liquid crystal video projection system.

[Description of the Related Arts]

Regarding conventional liquid crystal video projectors, a single-liquid-crystal-panel type comprises a light source lamp, an illuminating optical system, a liquid crystal panel, and a projection optical system,

or the above-described elements and a color filter, a three-liquid-crystal-panel type comprises a light source lamp, a color separation optical system, an illuminating optical system, a liquid crystal panel, an image synthesis optical system, and a projection optical system, and, because, in both of them, the liquid crystal panel module is illuminated by a strong light of the light source and the cooling of the deflecting panels in the liquid crystal panel module and the light source are essential for projecting that, a cooling fan was used either in an intake or in an outlet to cool them.

[Problems to be solved by the Invention]

However, in the conventional liquid crystal video projection systems, since the deflecting plates in the liquid crystal panel module and the light source underwent cooling using a cooling fan only either in a intake or in an outlet, there was a problem that the loss of the cooling air inside the systems was large and that it was difficult to obtain a sufficient cooling capacity.

Then, in the present invention, it is an object to effectively increase the cooling capacity with both an intake fan and an outlet fan provided for cooling deflecting plates.

Furthermore, in the present invention, it is an object to effectively increase the cooling capacity with both an intake fan and an outlet fan provided for cooling the light source.

Furthermore, in the present invention, it is an object to effectively increase the cooling capacity with both of an intake fan and an outlet fan provided for cooling a color filter in a single-liquid-

crystal-panel video projector.

[Means for Solving the Problems]

A liquid crystal video projection system of the present invention contains a liquid crystal video projector comprising at least a light source lamp, an illuminating optical system, a liquid crystal panel, and a projection optical system and is characterized in that both an intake fan and an outlet fan are provided for cooling deflecting plates.

In the present invention, a liquid crystal video projection system as claimed in claim 1 is characterized in that both an intake fan and an outlet fan are provided for cooling a light source.

In the present invention, a liquid crystal video projection system as claimed in claim 1 is characterized in that both an intake fan and an outlet fan are provided for cooling a color filter.

Hereinafter, the present invention is described in detail with reference to the embodiments.

[Embodiments]

Fig. 1 shows a liquid crystal video projection system according to the present invention, and Fig. 2 shows a conventional liquid crystal video projection system.

Embodiment 1

Fig. 1 is a schematic illustration of a liquid crystal video projection system according to the present invention. This is an example in which an intake fan and an outlet fan are applied to a single liquid crystal panel video projector. A light source lamp is a 300-watt

halogen lamp. The light produced by the light source lamp 1 is, first, incident on a deflecting plate 4, and the deflected light is incident on a liquid crystal panel 5. In the case of a color liquid crystal video projector, a color filter 7 is contained inside the liquid crystal panel. After the light image-modulated by the liquid crystal panel has passed through a second deflecting plate 6, it is projected on a screen 9 by a projection lens 8.

Then, since the transmittance of the deflecting plate 4 is 40%, the remaining light is absorbed and changed into heat. In particular, since the first deflecting plate 4 is closer to the light source and the absolute quantity of the incident light is larger, the heat generation becomes larger. Since the transmittance of the color filter is about 30% for red, 60% for green, and 10% for blue, the heat generation here also becomes large.

In order to cool the system, an intake fan 2 and an outlet fan 3 were used in the present embodiment. These fans has a flow rate of 600 l/min. When measured by using a thermocouple, it was able to keep the temperature on the surface of the deflecting plate 4 at 51°C. Furthermore, it was able to keep the temperature on the surface of the color filter 7 at 48°C.

Fig. 2 shows a conventional liquid crystal video projection system. The construction made up of a light source lamp 1, a deflecting plate 4, a color filter 7, a liquid crystal panel 7, a deflecting panel 6, a projection lens 8, and a screen 9 is the same as that in Embodiment 1, but the air cooling fan system contains only an intake fan 2. In this

liquid crystal video projection system, when the temperature is measured by using a thermocouple, the surface of the deflecting plate 4 was 60°C and the surface of the color filter 7 was 56°C.

Embodiment 2

Fig. 3 shows how the light source lamp is cooled in a system according to the present invention.

The light source lamp 1 is a halogen type lamp. The output is 300 watts. An intake fan 2 and an outlet fan 3 are provided above and below the light source lamp 1. When the lamp was switched on and the temperature of the lamp was measured by a thermocouple, the front edge of the reflector was 150°C. Furthermore, for comparison purposes, when the upper outlet fan 3 in the lamp case was removed and the temperature of the lamp was measured, it was 185°C.

Embodiment 3

Fig. 4 is a top view of an optical system when the present invention is applied to a three-liquid-crystal-panel video projector.

The light produced by the light source lamp 1 is broken down into each of the primary colors of light, that is, blue, green, and red by a blue reflecting dichroic mirror 301 and a green reflecting dichroic mirror 302. After the blue light is separated from the white light by the blue reflecting dichroic mirror, it is reflected by an amplifying reflecting mirror 303 and reaches a blue liquid crystal panel. After the green light has passed through the blue reflecting dichroic mirror

301, it is separated from the red light by the green reflecting dichroic mirror 302 and then reaches a green liquid crystal panel. After the red light has been separated from the blue light and the green light by the blue reflecting dichroic mirror 301 and the green reflecting dichroic mirror 302, it is reflected twice by the amplifying reflecting mirror 303 and reaches a red liquid crystal panel.

The light of each color incident on the blue liquid crystal panel, the green liquid crystal panel, and the red liquid crystal panel, respectively, is image-modified by the liquid crystal panel. The light of each color passing through the liquid crystal panel is superimposed by a dichroic prism 305 to produce a composite image. In this dichroic prism, a blue reflecting dichroic film and a red reflecting dichroic film are disposed in a glass block such that they diagonally intersect each other to form a cross. The light passing through the liquid crystals is completely superimposed. The light which passes through the dichroic prism is projected on a screen by a projection lens 308.

Fig. 5 is a front view of the present embodiment. In the present embodiment, the cooling fans are disposed above and below the dichroic prism and aim to cool the deflecting plates 401, 403, 404, and 408. When the temperature of each deflecting plate was measured, the deflecting plate 401 was 58°C, the deflecting plate 403 was 55°C, and the deflecting plate 405 was 52°C.

A 250 W metal halide type was used for the light source lamp 1. Furthermore, a fan having a flow rate of 600 l/min was used for the cooling fans 2 and 3.

[Advantages]

As described above, according to the present invention, the cooling capacity was able to be effectively increased with both an intake fan and an outlet fan provided for cooling deflecting plates.

Furthermore, in the present invention, the cooling capacity was able to be effectively increased with both an intake fan and an outlet fan provided for cooling a light source.

Furthermore, in the present invention, the cooling capacity was able to be effectively increased with both an intake fan and an outlet fan provided for cooling a color filter in a single-liquid-crystal-panel video projector.

4. Brief Description of the Drawings

Fig. 1 shows a liquid crystal video projector having a single liquid crystal panel.

1 light source lamp

2 intake fan

3 outlet fan

4 deflecting plate

5 liquid crystal panel

6 deflecting plate

7 color filter

8 projection lens

9 screen

Fig. 2 shows a conventional liquid crystal video projector having a

single liquid crystal panel.

1 light source lamp

2 intake fan

4 deflecting plate

5 liquid crystal panel

6 deflecting plate

7 color filter

8 projection lens

9 screen

Fig. 3 shows a way to cool a light source lamp.

1 light source lamp

2 intake fan

3 outlet fan

10 lamp house

11 reflector

Fig. 4 is a top view of a liquid crystal video projector having three liquid crystal panels.

1 light source lamp

301 blue separating dichroic mirror

302 green separating dichroic mirror

303 amplifying reflecting mirror

305 dichroic prism

308 projection lens

311 blue liquid crystal panel

312 green liquid crystal panel

313 red liquid crystal panel

401 blue deflecting plate

402 blue deflecting plate

403 green deflecting plate

404 green deflecting plate

405 red deflecting plate

406 red deflecting plate

Fig. 5 is a front view of a liquid crystal video projector having three liquid crystal panels.

1 light source lamp

2 intake fan

3 outlet fan

303 amplifying reflecting mirror

305 dichroic prism

308 projection lens

311 blue liquid crystal panel

313 red liquid crystal panel

FIG. 1

1 LIGHT SOURCE LAMP

2 INTAKE FAN

3 OUTLET FAN

4 DEFLECTING PLATE

5 LIQUID CRYSTAL PANEL

6 DEFLECTING PLATE

7 COLOR FILTER

8 PROJECTION LENS

9 SCREEN

FIG. 2

FIG. 3

FIG. 4

FIG. 5